

Selva Zoque, Mexico: an important Mesoamerican tropical region for reptile species diversity and conservation

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Academic editor: Anthony Herrel | Received 27 April 2021 | Accepted 8 July 2021 | Published 3 August 2021

<http://zoobank.org/F1D9569A-E45E-4B64-857F-9832164D0DB0>

Citation: Aguilar-López JL, Luría-Manzano R, Pineda E, Canseco-Márquez L (2021) Selva Zoque, Mexico: an important Mesoamerican tropical region for reptile species diversity and conservation. ZooKeys 1054: 127–153. <https://doi.org/10.3897/zookeys.1054.67916>

Abstract

The Selva Zoque region is characterized by a great variety of ecosystems for which there is little information about reptile species diversity and their conservation status. This study is the first assessment of the species richness, composition, and conservation status of reptiles of this region. Additionally, this information is compared with that of seven other tropical regions in northern Mesoamerica. In total, 141 native reptile species belonging to 81 genera and 29 families are recorded for the Selva Zoque region. Sixty species (42% of the total) recorded in Selva Zoque are in high-risk categories according to the Mexican Ministry of the Environment, the highest number for the Mexican regions of Mesoamerica. According to the IUCN, six species are in high-risk categories, seven species are in Data Deficient, and 23 (16%) have not been evaluated yet. According to the Environmental Vulnerability Scores approach, 28 species (20%) are in the high vulnerability category. The Selva Zoque species composition is most similar to Los Tuxtlas and Lacandona regions, and most dissimilar to Sian Ka'an Biosphere Reserve. The reptilian fauna of Selva Zoque has a distinctive composition, with the highest number (11 species) of endemic reptiles in the northern Mesoamerican, and species from two biogeographic provinces: the Gulf of Mexico and

the Mexican Pacific Coast. These results indicate that the Selva Zoque is the most diverse region in native reptile species in northern Mesoamerica, highlighting it as extremely important for the conservation of the reptile fauna at local (southern Mexico) and regional levels (northern Mesoamerica).

Keywords

Compositional similarity, conservation value, Data Deficient, reptile fauna, species composition, species richness

Introduction

The 25 biodiversity hotspots identified by Myers et al. (2000) share two characteristics: each one harbors endemic plant species representing at least 0.5% of the global total, and have lost $\geq 70\%$ of their primary vegetation. Of these regions, Mesoamerica ranks fifteenth in relation to the latter characteristic (80% of primary vegetation lost; Myers et al. 2000), and ranks third in deforestation rate among the 13 hotspots for which information is available (Brooks et al. 2002). Despite this scenario, some areas still remain covered by primary vegetation (FAO 2011), highlighting the ongoing conservation value of this region.

One such region is the Selva Zoque, composed by the Uxpanapa-Chimalapas zone (UC) and El Ocote Biosphere Reserve, is located on the Isthmus of Tehuantepec in the states of Veracruz, Oaxaca, and Chiapas in southern Mexico. The Selva Zoque region is the second largest extension of well-conserved tropical forest in northern Mesoamerica, is a Pleistocene refuge with high number of endemic species (Pérez-Farrera et al. 2016), contains a large variety of vegetation types (Peterson et al. 2003) and has a broad range of elevation spanning 100 to 2300 m a.s.l. Additionally, the Selva Zoque region, together with the protected area La Sepultura Biosphere Reserve, in the state of Chiapas, make up the La Selva Zoque-La Sepultura Priority Conservation Area (Arriaga et al. 2000b). Currently, detailed knowledge of the vertebrate species diversity in the entire Selva Zoque, or a large portion of it, is available only for birds (Peterson et al. 2003), mammals (Lira-Torres et al. 2012), and amphibians (Aguilar-López et al. 2016a). For other groups such as reptiles, our knowledge of species richness, species composition, and conservation status is limited to El Ocote Biosphere Reserve, where the reptile diversity has been revised on several studies (Reynoso et al. 2011; Luna-Reyes et al. 2017; Muñoz-Alonso et al. 2017) and scarce in UC zone. Herpetological expeditions have been carried out in the UC zone since at least the middle of the last century (Taylor 1951; Duellman 1960; Lynch and Wake 1989) but have focused mainly on amphibians. Moreover, herpetofaunal collection has been limited to few localities, and extensive portions of the region remain with no information.

Worldwide, habitat modification represents the most common threat to terrestrial reptile species, with one in five species included in high-risk categories of extinction (Vulnerable, Endangered, or Critically Endangered) by the IUCN. A further one in five species is listed in the Data Deficient category, and four of ten have not been

evaluated according to the criteria of the Red List (Uetz et al. 2018; IUCN 2021). In Mexico, it is estimated that 13% of reptile species are threatened and for another 16% there is insufficient information (in Data Deficient category) to evaluate its extinction risk level (IUCN 2021). On the other hand, about half of the species are included in the high-risk of extinction categories on the species list compiled by the Mexican Ministry of the Environment (NOM-059-SEMARNAT-2010). Given the variety of tropical forests that cover the Selva Zoque region, along with its geographic location and environmental heterogeneity (Wendt 1987; de Teresa 2000; SEMARNAT 2001), a high reptile diversity may inhabit in this region, with a significant portion of species under high risk of extinction.

Based on a comprehensive review of databases, scientific literature, and fieldwork, we provide the first assessment of species richness, species composition and distribution, and conservation status of the reptile fauna inhabiting the Selva Zoque region. Additionally, we compared this information with other tropical regions on the northern end of Mesoamerica.

Materials and methods

Study site

The Selva Zoque region is located in southern Mexico east of the Isthmus of Tehuantepec (Fig. 1). Mountains and hills dominate the region (Wendt 1987; SEMARNAT 2001; Ortiz-Pérez et al. 2004). The region is covered by several vegetation types, the main ones are evergreen tropical forest (100–1000 m a.s.l.), semi-evergreen tropical forest (600–1200 m a.s.l.), deciduous tropical forest (100–600 m a.s.l.), tropical montane cloud forest (1100–1800 m a.s.l.) and pine-oak forest (1800–2300 m a.s.l.) (Wendt 1987; SEMARNAT 2001). Mean annual temperature ranges from 12 to 23 °C and mean annual rainfall ranges from 800 to 4400 mm (Vidal-Zepeda 1990; SEMARNAT 2001). We delimited the study area using the polygon set by Arriaga et al. (2000a) for the Selva Zoque-La Sepultura Priority Conservation Area but excluded La Sepultura Biosphere Reserve (Fig. 1).

Data collection

We consulted two databases between January 2017 and May 2021: the National Information System on Biodiversity (**SNIB**) curated by the National Commission for the Knowledge and Use of Biodiversity (**CONABIO**) and the Global Biodiversity Information Facility (GBIF; www.gbif.org). We also reviewed the scientific literature on reptiles from the study region (Navarro-Singüenza and Meave-Castillo 1998; Espinoza et al. 1999; Reynoso et al. 2011; Carmona-Torres 2013; Aguilar-López et al. 2014; Canseco-Márquez and Ramírez-González 2015; Scarpetta et al. 2015; Aguilar-López et al. 2016b; Gray et al. 2016; Luna-Reyes et al. 2017; Muñoz-Alonso et al. 2017;

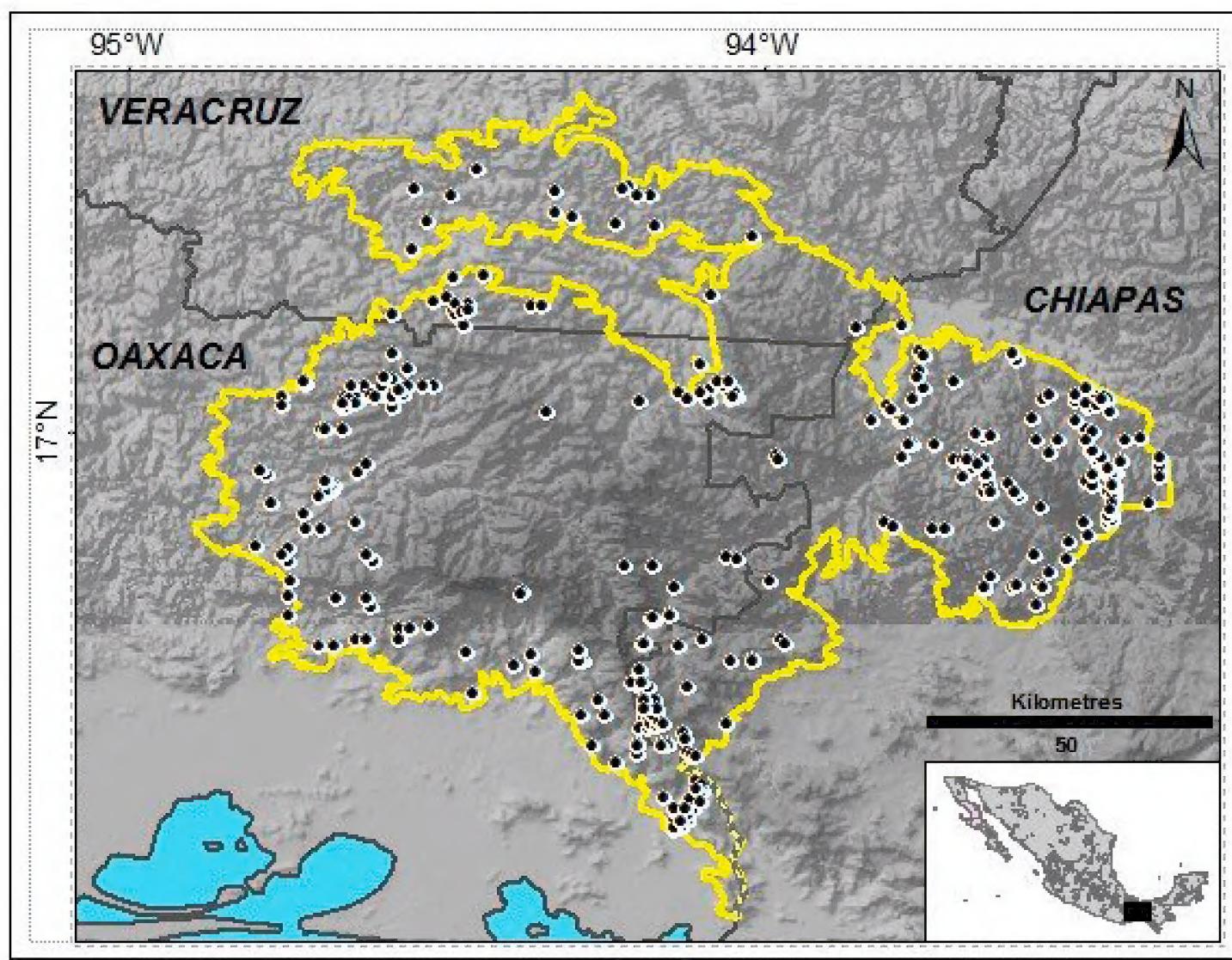


Figure 1. Location of the Selva Zoque region. The yellow line denotes our study area limits, the thin black line indicates state boundaries, and black circles denote localities in which reptiles have been recorded.

Campbell et al. 2018; del Moral-Flores et al. 2019). Additionally, we conducted field-work during 2013 and 2014 in surroundings of Arroyo Zarco, Uxpanapa, in Veracruz ($17^{\circ}11'N$, $94^{\circ}28'W$), and San Francisco La Paz ($17^{\circ}5'N$, $94^{\circ}8'W$), La Fortaleza ($17^{\circ}9'N$, $94^{\circ}13'W$), and La Esmeralda ($17^{\circ}9'N$, $94^{\circ}46'W$), in Santa María Chimalapa, Oaxaca. We surveyed areas with evergreen tropical forest and semi-evergreen tropical forest using standard visual encounter survey techniques (Crump and Scott 1994) during the day and at night. Cumulative sampling effort was 3250 person-hours.

We cross-checked records obtained from the three sources of information to avoid duplication, since the databases consulted might have records of the same specimens. Only records with precise geographic coordinates or detailed information about the collection and observation site were included, and from these records we compiled a general database.

To compare the data we compiled for the Selva Zoque region with the data from seven other tropical regions, we obtained information about reptile species richness and species composition from: 1) Los Tuxtlas in Veracruz (López-Luna 2017), 2) Las Choapas municipality in Veracruz (Aguilar-López and Canseco-Márquez 2006), 3) La Sepultura Biosphere Reserve in Chiapas (Nuñez-Orantes and Muñoz-Alonso 2000; Reynoso et al. 2011; Clause et al. 2020a, b), 4) the Lacandona rainforest in Chiapas (Hernández-Ordóñez et al. 2015), 5) the Calakmul Biosphere Reserve in Campeche

(Calderón-Mandujano et al. 2010; Colston et al. 2015), 6) the Sian Ka'an Biosphere Reserve in Quintana Roo (Calderón-Mandujano et al. 2008), and 7) the Mayan Forest in Guatemala (Lee 1996; Campbell 1998).

Data processing and analysis

To identify the spatial distribution of reptile records in the study region, we projected all geo-referenced records onto our study area polygon using ArcGIS software, version 10.0 (ESRI 2010). To determine the distribution and taxonomically standardize the data set of species that inhabit the Selva Zoque and the other tropical regions, we consulted the specialized literature documenting taxonomic changes and descriptions of new species (Wüster et al. 2005; Castoe et al. 2009; Köhler 2010; Linkem et al. 2011; Cadle and Savage 2012; Hedges and Conn 2012; Iverson et al. 2013; Porras et al. 2013; Köhler et al. 2014; Ruane et al. 2014; Blair et al. 2015; Meza-Lázaro and Nieto-Montes de Oca 2015; Card et al. 2016; Gray et al. 2016; Köhler et al. 2016; McCranie and Hedges 2016; Wallach 2016; Nieto-Montes de Oca et al. 2017; Campbell et al. 2018; Carbajal-Márquez et al. 2020; Jadin et al. 2020; McCranie et al. 2020; Reyes-Velasco et al. 2020; Ramírez-Reyes et al. 2021). Using the compiled data, we defined four distribution categories: species distributed outside Mesoamerica as widely distributed species (WD), species restricted to Mesoamerica (MA), species restricted to northern Mesoamerica (MAMx), and species restricted to one of the eight regions considered. We delimited Mesoamerica as suggested by Campbell (1999) and considered northern Mesoamerica as the zone corresponding to Mexico. To determine the extinction risk category for each species, we consulted the list of Species at Risk published by SEMARNAT, updated in 2018 (NOM-059-SEMARNAT-2010), the Red List maintained by the International Union for the Conservation of Nature (IUCN 2021), and the Environmental Vulnerability Score (EVS) proposed by Wilson et al. (2013). SEMARNAT's categories are: Subject to Special Protection (Pr), Threatened (A), and Endangered (P). The IUCN's three high-risk categories are: Vulnerable (VU), Endangered (EN) and Critically Endangered (CR); its low-risk categories are: Least Concern (LC) and Near Threatened (NT). We also included species in the Data Deficient (DD) category, and those Not evaluated (NE) by the IUCN. In addition, we consulted the EVS of Mexican reptile species that have been evaluated and assigned to one of three categories of vulnerability to environmental degradation: low (3–9), medium (10–13) and high (14–19). For the Mayan Forest in Guatemala, we were only able to assign the IUCN categories since the area lies outside of SEMARNAT's jurisdiction and there is not an evaluation of EVS for reptiles of Guatemala.

We compared reptilian faunal composition between regions using Jaccard's similarity index (Magurran 2004), which uses presence-absence data and is expressed as:

$$C_j = \frac{a}{a+b+c}$$

where α = the number of species shared between the two sites under comparison, b = number of species exclusive to the first site, and c = number of species exclusive to the second site. The index ranges from zero to one, with zero indicating that no species are shared between the sites being compared, and one indicating that all species are found in both sites. We plotted a dendrogram using PAST software version 2.17c (Hammer et al. 2001) to represent the relationship between sites in terms of their similarity in species composition according to the Jaccard index. For this analysis, we only included native species.

Results

Species richness, distribution, and conservation status

A total of 141 native reptile species belonging to 81 genera and 29 families has been recorded at the Selva Zoque region. These comprise 62 species of lizards, 70 snakes, seven turtles, and two crocodilians (Appendix 1). The best represented families are Dipsadidae and Colubridae, with 29 and 25 species, respectively, followed by Dactyloidae with 18 species, Phrynosomatidae with nine species, and Viperidae with seven species. The families with the fewest species in the region are Eublepharidae, Helodermatidae, Mabuyidae, Phyllodactylidae, Scincidae, Boidae, Natricidae, Sybinophiidae, Leptotyphlopidae, Loxocemidae, Dermatemydidae, Emydidae, and Geoemydidae, with one species each one. Three non-native species have been recorded in the region, the lizards *Anolis sagrei* Duméril & Bibron, *Gehyra mutilata* (Wiegmann) and *Hemidactylus frenatus* Duméril and Bibron. During our fieldwork (2013–2014), we recorded 48 species (Appendix 1), although all of them had been previously recorded.

Reptiles have been recorded mostly on the periphery of the study region, notably on western, southern and eastern end portions. In the northwest, northeast, and west, reptile collections are located below 1000 m a.s.l., while in the southeast, most of collections are between 1000 and 2000 m a.s.l. The central portion of Chimalapas, the mountainous zone known as Espinazo del Diablo in Uxpanapa and a zone between El Ocote Biosphere Reserve and UC zones corresponding to the northwest extreme of Cintalapa in Chiapas, remain with no collection of reptiles (Fig. 1). The distribution of eleven of the 141 native species (8%) is restricted to the Selva Zoque region, 26 species (18%) are distributed in the northern part of Mesoamerica that corresponds to Mexico, 66 species (47%) are distributed on Mesoamerica, and 38 species (27%) have a wide distribution, extending beyond Mesoamerica (Appendix 1).

Of the reptile species recorded in the Selva Zoque region, 60 species (42%) are in high-risk categories according to SEMARNAT: 39 species in the Subject to Special Protection category (Pr), 18 species are in the Threatened category (A) and three are Endangered (P). According to the IUCN Red List, six species (4%) are included in high-risk categories: three are Vulnerable (VU), two are Endangered (EN), and one is Critically Endangered (CR). Additionally, seven species are in the Data Deficient cat-

egory (DD) and 23 species have not been evaluated (NE). The remaining 105 species are in low-risk categories. According to the EVS system, 28 species (20%) are in the high vulnerability category (Appendix 1).

Comparison of the richness, composition, and conservation status of the reptile species from the Selva Zoque region with that of other tropical regions

With 141 native species recorded, the Selva Zoque region harbors the highest reptile species richness among the tropical regions considered in this study, surpassing Los Tuxtlas (113 species). The Mayan Forest ranks third (107 species), followed by La Lacandona (89 species), La Sepultura (79 species), Calakmul (73 species), Sian Ka'an (63 species), and finally Las Choapas (56 species; Table 1). The Los Tuxtlas Biosphere Reserve, with four species, has the highest diversity of non-native species, followed by Selva Zoque and Calakmul with three. La Sepultura, Sian Ka'an, and Las Choapas have two non-native species, and the Mayan Forest and Lacandona each have only one.

The dendrogram indicates that La Sepultura has the most dissimilar species composition of the nine regions (Fig. 2). This Biosphere Reserve is followed by Selva Zoque, Las Choapas and Los Tuxtlas in terms of their dissimilarity in relation to the remaining regions. The four remaining regions in turn form a group with a value of Jaccard index [C_j] = 0.5 (Fig. 2). The composition analysis by pairs indicates that Los Tuxtlas had the species composition most similar to that of Selva Zoque, with 44% shared species (C_j = 0.44), followed by Lacandona (C_j = 0.39), whereas the region with the least similar species composition to Selva Zoque was Sian Ka'an (C_j = 0.20). The regions with the most similar species composition were Lacandona and Mayan Forest in Guatemala (C_j = 0.72), followed by Sian Ka'an and Calakmul (C_j = 0.58). The least similar regions were Sian Ka'an and La Sepultura (C_j = 0.14).

The Selva Zoque and Los Tuxtlas regions have the highest number of endemic species to the regions, with eleven each, followed by La Sepultura (three species) and Mayan Forest with one endemic species while the rest of regions do not have endemic species (Appendix 1). Also, the Selva Zoque region has the highest number of species in high-risk categories of extinction according to the NOM-059 criteria, with 60 spe-

Table 1. Taxonomic composition of native reptile species recorded in the Selva Zoque region and seven other regions in northern Mesoamerica. Non-native species are not included in the taxonomic composition data.

Tropical region	Orders	Families	Genera	Lizards	Snakes	Turtles	Crocodilians	Native species	Non-native species
Selva Zoque	3	29	81	62	70	7	2	141	3
Los Tuxtlas	3	29	75	35	63	14	1	113	4
Mayan Forest	3	26	70	35	61	9	2	107	1
Lacandona	3	25	64	28	52	7	2	89	1
La Sepultura	2	25	59	29	47	3	0	79	2
Calakmul	3	21	51	24	39	9	1	73	3
Sian Ka'an	3	23	51	25	26	10	2	63	2
Las Choapas	3	20	41	20	28	7	1	56	2

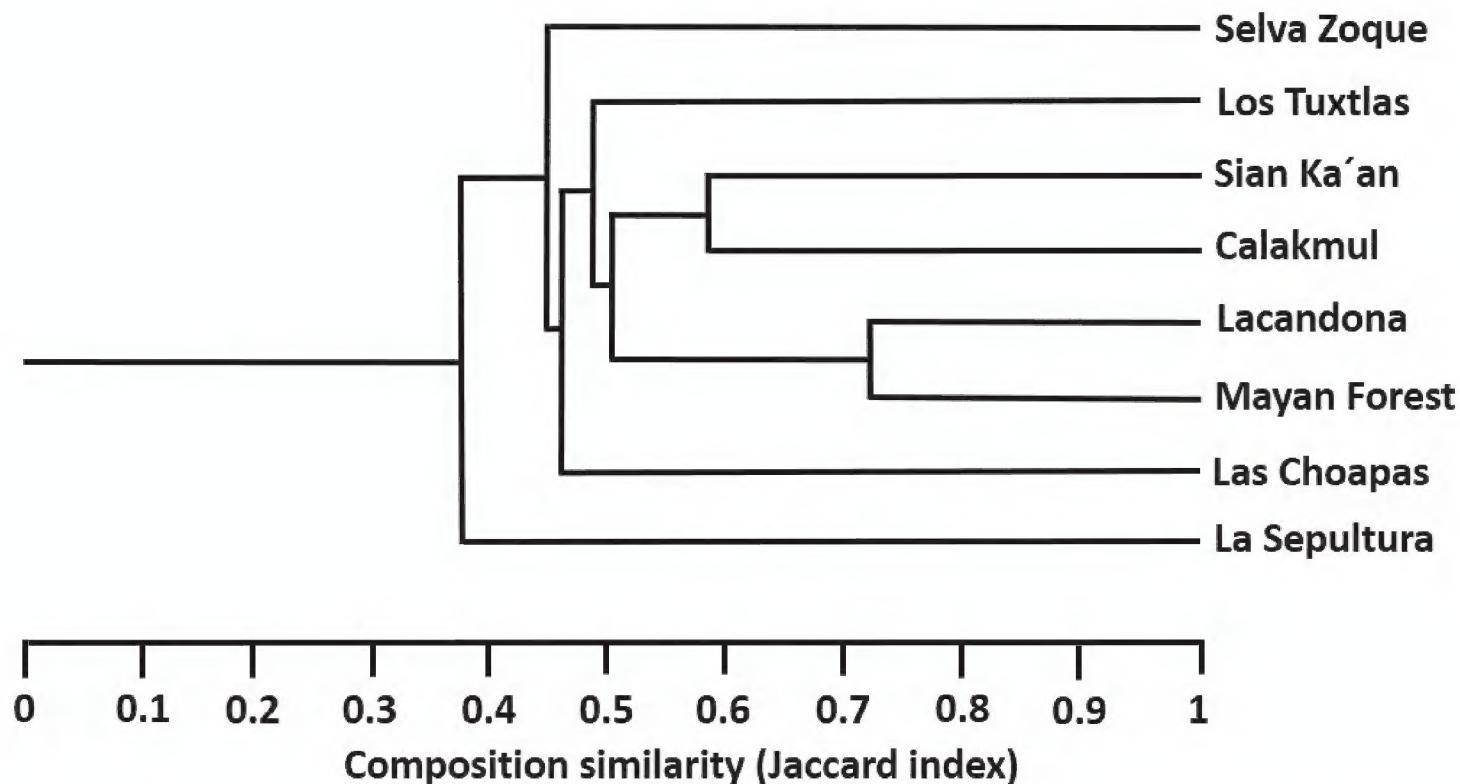


Figure 2. Similarity in reptile species composition for eight tropical areas in northern Mesoamerica.

cies, followed by Los Tuxtlas with 46 species. The other regions have from 33 species (La Sepultura) to 25 species (Las Choapas) in high-risk categories (Fig. 3A). Based on the IUCN Red List, the number of reptiles in high-risk categories of extinction is highest in Los Tuxtlas, with ten species, and the other regions have from one to six species in these categories. The Selva Zoque region has the highest number of species classified as Not evaluated (NE) and with Data Deficient (DD) on the IUCN Red List with 30 species, followed by Los Tuxtlas (24 species); the remaining regions have from eight to 14 NE and DD species (Appendix 1; Fig. 3B). The Selva Zoque has the highest number of species (28) included in the high vulnerability category to environmental degradation, followed by Los Tuxtlas with 18 species; the remaining regions have between five and ten species (Fig. 3C).

Discussion

Our results show that the Selva Zoque region harbors the greatest reptile species richness in northern Mesoamerica, with a distinctive species composition and several species inhabit exclusively on Selva Zoque region. Furthermore, one in every two reptile species that inhabit in Selva Zoque is threatened, is highly vulnerable or there is not sufficient information to know its extinction risk level. All this underscore the importance of the Selva Zoque region for reptile conservation in Mexico and Mesoamerica. This region also offers opportunities to study unexplored well-preserved tropical forest areas, as well as species for which little is known about their biology, ecology, and conservation status.

The Selva Zoque region is more diverse in native reptile species than even Los Tuxtlas, which has 28 fewer native species (López-Luna 2017). In the Selva Zoque region three exotic species (*Anolis sagrei*, *Gehyra mutilata*, *Hemidactylus frenatus*) have

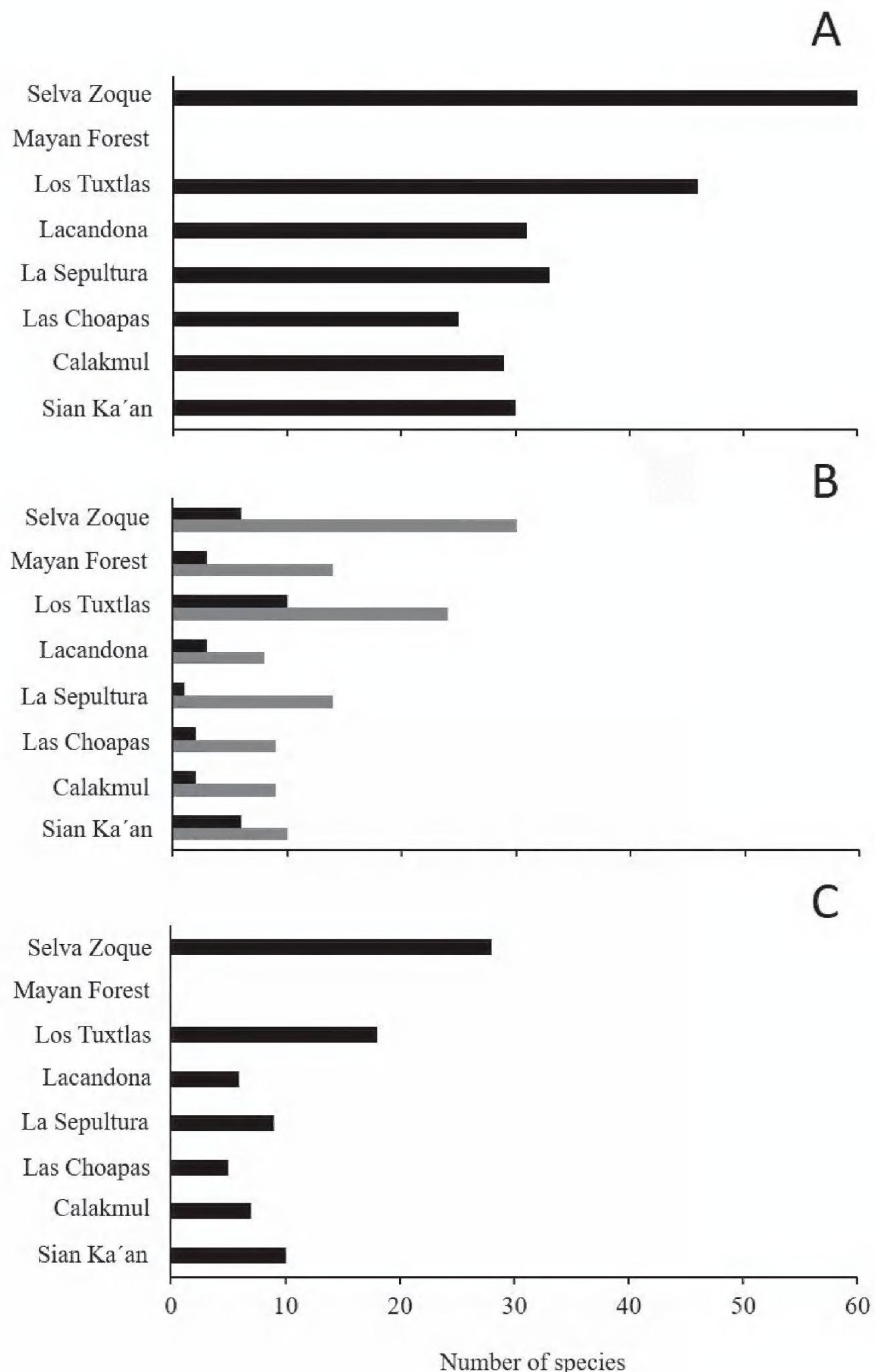


Figure 3. Number of reptile species in high extinction-risk categories according to **A** NOM-059-SEMARNAT-2010 **B** IUCN Red List, and **C** the Environmental Vulnerability Score, for eight tropical regions in northern Mesoamerica. The black bars in the three plots represent the number of species in high extinction-risk categories, and the grey bars in the graph B represent the number of species not evaluated or in the Data Deficient category by the IUCN.

been recorded, fewer than other regions such as Los Tuxtlas, which is located near the coast. The occurrence of the highest diversity of native species in some portions of Selva Zoque over that of other tropical regions has been previously observed in amphibians (Aguilar-López et al. 2016a). The 141 native reptile species recorded in the Selva Zoque region represent 16% of the 864 reptile species recorded in Mexico (Flores-Villela and García-Vázquez 2014), 52% of the 270 reptile species recorded in south-eastern Mexico (Johnson et al. 2010), and 11% of the 1284 species recorded in Mesoamerica (Johnson et al. 2018).

That said, the inventory of reptile species in the Selva Zoque region is far from complete, particularly in UC zones. In the last three years alone, three new species have been described (*Anolis purpuronectes* [Gray et al. 2016], *Chersodromus australis* [Canseco-Márquez et al. 2018] and *Cenaspis aenigma* [Campbell et al. 2018]), and more species await formal description. Furthermore, several zones within our study area lack reptile records entirely and remain unexplored, and hence additional surveys could reveal reptile species unrecorded for the region and perhaps altogether new species to science. As such, the species richness we report here is likely an underestimate, highlighting the need for additional sampling effort to complete the species inventory of the Selva Zoque region.

The high species richness in the Selva Zoque region may be the result of a series of factors. One is the notably complex orography with lowland zones, both on the Gulf of Mexico and on the Pacific versant, and also a series of mountain ranges of intermediate elevation—the Sierra Atravesada, the Espinazo del Diablo, the Sierra Tres Picos, and Cerro La Colmena (Wendt 1987; Ortíz-Pérez et al. 2004; SEMARNAT 2001)—with elevations from 100 to 2300 m a.s.l. There is a range of 11 °C in mean annual temperature across this elevation gradient, and a difference of 3600 mm in mean annual rainfall across the Selva Zoque (Beard 1955; SEMARNAT 2001). In addition, at least seven vegetation types exist in the region (Arriaga et al. 2000b; SEMARNAT 2001). Together, these factors create a wide variety of habitats for a large diversity of reptile species with different eco-physiological requirements and evolutionary histories.

Although the Selva Zoque did not result clustered with any of the regions in the similarity analysis, Los Tuxtlas and Lacandona Biosphere Reserves are the most similar tropical regions to the Selva Zoque. This pattern has been observed for amphibians in a comparison between Uxpanapa-Chimalapas zone and the same tropical regions (except from La Sepultura) used in this study, and can be explained by the high number of recorded species in these three sites and the high number of species that they share. The Selva Zoque reptile fauna has a combined component of species from two different biogeographic provinces (Morrone 2005): species found in the province of Gulf of Mexico (e.g., *Anolis sericeus* Hallowell, *Holcosus amphigrammus* (Smith and Laufe), and those in the province of Mexican Pacific Coast (e.g., *Loxocemus bicolor* Cope, *Portidium dunni* (Hartweg and Oliver), *Rhinoclemmys rubida* (Cope)). The high percentage (8%) of endemism of reptile species to the Selva Zoque region may be due to its stable Pleistocene climate conditions, which allowed for the diversification of different biological groups (Lira-Torres et al. 2012; Rodríguez-Gómez et al. 2013). A pattern

of high endemicity of the whole Selva Zoque region has been observed for mammals (Escalante 2003), but also in parts of Selva Zoque region like Uxpanapa-Chimalapas for other vertebrates as amphibians (Aguilar-López et al. 2016) or for Chimalapas zone in the case of birds (Peterson et al. 2003).

Our results suggest that Selva Zoque is a priority conservation area for the reptile fauna of Mexico because a relatively high proportion (43%) of the species that inhabit there are in high-risk of extinction categories in the NOM-059; equivalent to 33% of all the Mexican reptile species included in this initiative (SEMARNAT 2010). Additionally, a moderate number of reptile species are in the high vulnerability category of environmental degradation (20%). In contrast, Selva Zoque does not harbor a high number of species in high-risk categories of extinction according to the IUCN. The differences in the number of species in high risk of extinction among initiatives is presumably because the NOM-059 does not consider the entire distribution of the species, it only takes into account the distribution of the species within the Mexican territory, which may lead to a restricted distribution, but only within Mexico, this does not necessarily reflect the entire distribution of the species. Additionally, populations of some reptile species that occur within Mexico may be scarce or may be declining, while populations of those species but outside of Mexico may be stable. Even so, the importance of Selva Zoque region lies in the relatively high proportion (21%) of species that are classified as Not evaluated (NE) and Data Deficient (DD). Because of the conservation status of vegetation in some areas of the region, it represents an opportunity for gathering information on the biology of these species, and this could contribute to their being assigned a category. This is the case for *Abronia bogerti* Tihen, *Anolis alvarezdeltoroi* Nieto Montes de Oca, *Xenosaurus arboreus* (Lynch and Smith), and *Tantilla briggsi* Savitsky and Smith (Fig. 4A, B, E, G), endemic species to the Selva Zoque region, or species with distribution in Mesoamerica as *Trimorphodon biscutatus* (Duméril, Bibron and Duméril), and *Epictia phenops* (Cope) (Fig. 4H, I). In any case, though widely distributed, some reptile species are considered threatened under three classification systems, such as *Anolis pygmaeus* Alvarez del Toro & Smith *Bothriechis rowleyi* (Bogert), *Dermatemys mawii* Gray and *Crocodylus acutus* (Cuvier) (Fig. 4C, J, K, L), all of which have been reported for the other regions (Appendix 1; Fig. 3).

The extensive areas of well-preserved forest in Selva Zoque are mostly located in the Chimalapas zone and El Ocote Biosphere Reserve (Flamenco-Sandoval et al. 2007; Lira-Torres et al. 2012), and offer an opportunity not only for the conservation of reptile diversity, but also for all the biotic diversity that inhabits the Selva Zoque region. Conservation is under the aegis of community initiatives in Chimalapas and has been successful in recent decades (Monterrubio-Solís and Newing 2013); however, it is necessary to implement and subsequently strengthen conservation efforts in areas without any protection. For Uxpanapa and the intermediate zones between Uxpanapa and El Ocote Biosphere Reserve, the constant and accelerated transformation of the original vegetation cover into crops and pastureland (Flamenco-Sandoval et al. 2007; Hernández et al. 2013) underscores the urgent need to stop the advance of the agricultural frontier (Arriaga et al. 2000b).



Figure 4. Reptile species in high extinction-risk categories by IUCN, NOM or EVS initiatives, or listed as Data Deficient or Not evaluated by the IUCN red list (see text) **A** *Abronia bogerti* **B** *Anolis alvarezdeltoroi* **C** *Anolis pygmaeus* **D** *Lepidophyma tuxtlae* **E** *Xenosaurus arboreus* **F** *Xenosaurus rackhami* **G** *Tantilla briggsi* **H** *Trimorphodon biscutatus* **I** *Epictia phenops* **J** *Bothriechis rowleyi* **K** *Dermatemys mawii* and **L** *Crocodylus acutus*.

The implementation of activities proven to be effective in the conservation of reptiles in transformed landscapes in the study region is desirable. These could include: 1) ecological restoration (Smith et al. 2015) to facilitate the recovery of the reptile communities over time, 2) the protection of vegetation remnants (Pulsford et al. 2017) that can harbor important components of overall species diversity, and 3) protection of buffer zones around water bodies (Semlitsch and Bodie 2003) that maintain populations of several species, and also constitute biological corridors (Burbrink et al. 1999). Finally, the protection of Uxpanapa portion of Selva Zoque can contribute to the connection of natural protected areas of different governance types in the western (community protected areas of the Chimalapas, in Oaxaca) and eastern (federal protected area El Ocote, in Chiapas) of Selva Zoque (García-Bañuelos et al. 2019). This idea fits completely with the objective of the Mesoamerican Biological Corridor, an interna-

tional initiative that aims to maintain biological diversity, decrease habitat fragmentation, improve the connectivity of the landscapes and of the ecosystems in Mesoamerica and to impulse social and economic development (Miller et al. 2001).

Acknowledgements

The authors thank A. Vinalay, C. Nochebuena, D. Aportela, L. Vázquez, L. Alcaide, J. López, M. Oropeza, R. Flores, J. Pelayo, I. Caviedes, F. Vázquez, C. Hernández, and U. García for helping with the fieldwork. Policarpo Ronzón, L. Feria, and A. Vázquez provided logistical support for the trips to the field. The authors are grateful to M. López-Luna for providing the photograph of *Crocodylus acutus*, to I. Ahumada for providing the photograph of *Bothriechis rowleyi*, and to L. Badillo for providing the photograph of *Epictia phenops*. P. Bañuelos prepared the map and B. Delfosse and A. Clause revised the English of the manuscript. The Toala and Chacha families provided accommodation and were our field guides during our work in Uxpanapa. J. Campbell kindly reviewed an early version of the manuscript and offered helpful suggestions, and Roberto Luna-Reyes made useful suggestions on an advanced version of the manuscript. JLAL was awarded graduate studies scholarship No. 344651 by CONACYT. Permits for this study were issued by the Mexican Wildlife Agency, Dirección General de Vida Silvestre of the Secretaría de Medio Ambiente y Recursos Naturales (collecting permit numbers: SGPA/DGVS/03665/06 and SGPA/DGVS/03444/15). This study was funded by project JF-212-CONABIO.

References

- Aguilar-López JL, Canseco-Márquez L (2006) Herpetofauna del municipio de Las Choapas, Veracruz, México. Boletín de la Sociedad Herpetológica Mexicana 14: 20–37.
- Aguilar-López JL, Canseco-Márquez L, Pineda E, Luría-Manzano R (2014) Aporte al conocimiento de la distribución de la culebra de cola corta de Linton, *Tantillita lintoni* en México. Revista Mexicana de Biodiversidad 96: 1292–1294. <https://doi.org/10.7550/rmb.46781>
- Aguilar-López JL, Luría-Manzano R, Pineda E, Aportela D (2016b) *Celestus rozellae*. Distribution note. Mesoamerican Herpetology 3: 764–765.
- Aguilar-López JL, Pineda E, Luría-Manzano R, Canseco-Marquez L (2016a) Species diversity, distribution and conservation status in a Mesoamerican region: Amphibians of the Uxpanapa-Chimalapas region, Mexico. Tropical Conservation Science 9: 1–16. <https://doi.org/10.1177/1940082916670003>
- Arriaga L, Espinoza JM, Aguilar C, Martínez E, Gómez L, Loa E [Coordinators] (2000a) Mapa de regiones terrestres prioritarias de México. Escala de trabajo 1:1 000 000. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México.
- Arriaga L, Espinoza JM, Aguilar C, Martínez E, Gómez L, Loa E [Coordinators] (2000b) Regiones terrestres prioritarias para la conservación. México, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.

- Beard JS (1955) The classification of tropical American vegetation types. *Ecology* 36: 89–100. <https://doi.org/10.2307/1931434>
- Blair C, Méndez de la Cruz FR, Law C, Murphy RW (2015) Molecular phylogenetics and species delimitation of leaf-toed geckos (Phyllodactylidae: *Phyllodactylus*) throughout the Mexican tropical dry forest. *Molecular Phylogenetics and Evolution* 84: 254–265. <https://doi.org/10.1016/j.ympev.2015.01.003>
- Brooks TM, Mittermeier RA, Mittermeier CG, Da Fonseca GAB, Rylands AB, Konstant WR, Flick P, Pilgrim J, Olfield S, Magin G, Hilton-Taylor C (2002) Habitat loss and extinction in the hotspot of biodiversity. *Conservation Biology* 16: 909–923. <https://doi.org/10.1046/j.1523-1739.2002.00530.x>
- Burbrink FT, Phillips CA, Heske EJ (1999) A riparian zone in southern Illinois as a potential dispersal corridor for reptiles and amphibians. *Biological Conservation* 86: 107–115. [https://doi.org/10.1016/S0006-3207\(98\)00054-8](https://doi.org/10.1016/S0006-3207(98)00054-8)
- Cadle JE, Savage JM (2012) Systematics of the *Dendrophidion nuchale* complex (Serpentes: Colubridae) with the description of a new species from Central America. *Zootaxa* 3513: 1–50. <https://doi.org/10.11646/zootaxa.3513.1.1>
- Calderón-Mandujano RR, Bahena-Basave H, Calmé S (2008) Anfibios y reptiles de la Reserva de la Biosfera de Sian Ka'an y zonas aledañas (2nd edn.). COMPACT, ECOSUR, CONABIO, S.H.M, Quintana Roo, 111 pp.
- Calderón-Mandujano RR, Pozo de la Tijera C, Cedeño-Vázquez JR (2010) Guía Rústica de los Reptiles de la Región de Calakmul, Campeche, México. ECOSUR, CONABIO, Quintana Roo, 57 pp.
- Campbell JA (1984) A new species of *Abronia* (Sauria: Anguidae) with comments on the herpetogeography of the highlands of southern Mexico. *Herpetologica* 40: 373–381. <https://www.jstor.org/stable/3892089>
- Campbell JA (1998) Amphibians and reptiles of Northern Guatemala, the Yucatan, and Belize. Vol. 4, Animal Natural History Series. University of Oklahoma Press, Norman, 400 pp.
- Campbell JA (1999) Distribution patterns of amphibians in Middle America. In: Duellman WE (Ed.) Patterns of distribution of amphibians, a global perspective. The Johns Hopkins University Press, Baltimore, 111–210.
- Campbell JA, Smith EN, Hall AS (2018) Caudals and calyces: the curious case of a consumed Chiapan colubroid. *Journal of Herpetology* 52: 459–472. <https://doi.org/10.1670/18-042>
- Canseco-Márquez L, Ramírez-González CG (2015) New herpetofaunal records for the state of Oaxaca, Mexico. *Mesoamerican Herpetology* 2: 364–367.
- Canseco-Márquez L, Ramírez-González CG, Campbell JA (2018) Taxonomic review of the rare Mexican snake genus *Chersodromus* (Serpentes: Dipsadidae), with the description of two new species. *Zootaxa* 4399: 151–169. <https://doi.org/10.11646/zootaxa.4399.2.1>
- Carbajal-Márquez RA, Cedeño-Vázquez JR, Martínez-Arce A, Neri-Castro E, Machkour-M'Rabet SC (2020) Accessing cryptic diversity in Neotropical rattlesnakes (Serpentes: Viperidae: *Crotalus*) with the description of two new species. *Zootaxa* 4729: 451–481. <https://doi.org/10.11646/zootaxa.4729.4.1>
- Card DC, Schield DR, Adams RH, Corbin AB, Perry BW, Andrew AL, Pasquesi GIM, Smith EN, Jezkova T, Boback SM, Booth W, Castoe TA (2016) Phylogeographic and population genetic analyses reveal multiple species of *Boa* and independent origins of insular dwarf-

- ism. *Molecular Phylogenetics and Evolution* 102: 104–116. <https://doi.org/10.1016/j.ympev.2016.05.034>
- Carmona-Torres HF (2013) Diversidad herpetofaunística en remanentes de selva alta perennifolia y su relación con áreas conservadas. Ms thesis, National Autonomous University of Mexico, Mexico.
- Castoe TA, Daza JM, Smith EN, Sasa MM, Kuch U, Campbell JA, Chippindale PT, Parkinson CL (2009) Comparative phylogeography of pitvipers suggests a consensus of ancient Middle American Highland biogeography. *Journal of Biogeography* 36: 88–103. <https://doi.org/10.1111/j.1365-2699.2008.01991.x>
- Clause AG, Luna-Reyes R, Nieto-Montes de Oca A (2020a) A new species of *Abronia* (Squamata: Anguidae) from a Protected Area in Chiapas, Mexico. *Herpetologica* 76: 330–343. <https://doi.org/10.1655/Herpetologica-D-19-00047>
- Clause AG, Luna-Reyes R, Jimenez-Lang N, Nieto-Montes de Oca A, Martínez-Hernández LA (2020b) Problems with imperfect locality data: distribution and conservation status of an enigmatic pitviper. *Amphibian & Reptile Conservation* 14: 185–197.
- Colston TJ, Barao-Nóbrega JA, Manders R, Lett A, Willmott J, Cameron G, Hunter S, Radage A, Littlefair E, Williams RJ, López-Cen A, Slater K (2015) Amphibians and reptiles of the Calakmul Biosphere Reserve, México, with new records. *Check List* 11: 1–7. <https://doi.org/10.15560/11.5.1759>
- Crump ML, Scott Jr NJ (1994) Visual encounter surveys. In: Heyer RW, Donnelly MA, McDiarmid RW, Hayek LC, Foster MS (Eds) *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Smithsonian Institution Press, Washington and London, 84–92.
- de Teresa AP (2000) Los Vaivenes de la Selva: el Proceso de Reconstitución del Territorio Zoque de los Chimalapas. México. Universidad Autónoma Metropolitana, Consejo Nacional de Ciencia y Tecnología y Secretaría de Medio Ambiente, Recurso Naturales y Pesca, México, 180 pp.
- del Moral-Flores LF, Vázquez-Nuñez LG, Hernández-Arellano T (2019) Primer registro del cocodrilo de pantano *Crocodylus moreletii* Duméril & Bibron 1851, en la selva de Los Chimalapas, Oaxaca, México. *Revista Latinoamericana de Herpetología* 2: 51–54.
- Duellman WE (1960) A distributional study of the amphibians of the Isthmus of Tehuantepec, Mexico. University of Kansas publications, Museum of Natural History 13: 19–72.
- Escalante-Espinosa T (2003) Determinación de prioridades en las áreas de conservación para los mamíferos terrestres de México, empleando criterios biogeográficos. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología* 74: 211–237.
- Espinoza ME, Núñez H, González P, Luna R, Navarrete GD, Cruz E, Guichard C (1999) Lista preliminar de los vertebrados terrestres de la selva “El Ocote”, Chiapas. *Publicación Especial del Instituto de Historia Natural* 2: 1–40.
- ESRI (2010) ArcGIS (Version 10.0). Environmental Systems Research Institute, Redlands.
- FAO (2011) State of the World’s Forests. Food and Agriculture Organization of the United Nations, Rome, 164 pp.
- Flamenco-Sandoval A, Martínez-Ramos M, Masera OR (2007) Assessing implications of land-use and land-cover change dynamics for conservation of a highly diverse tropical rain forest. *Biological Conservation* 138: 131–145. <https://doi.org/10.1016/j.biocon.2007.04.022>
- Flores-Villela O, García-Vázquez UO (2014) Biodiversidad de Reptiles en México. *Revista Mexicana de Biodiversidad* 85: S467–S475. <https://doi.org/10.7550/rmb.43236>

- García-Bañuelos P, Rovito SM, Pineda E (2019) Representation of threatened biodiversity in protected areas and identification of complementary areas for their conservation: plethodontid salamanders in Mexico. *Tropical Conservation Science* 12: 1–15. <https://doi.org/10.1177/1940082919834156>
- Gray L, Meza-Lázaro R, Poe S, Nieto Montes de Oca A (2016) A new species of semiaquatic *Anolis* (Squamata: Dactyloidae) from Oaxaca and Veracruz, Mexico. *Herpetological Journal* 26: 253–262.
- Hammer O, Harper DAT, Ryan PD (2001) Past: Paleontological Statistics software package for education and data analysis. *Paleontologica Electronica* 4: 1–9.
- Hedges SB, Conn CE (2012) A new skink fauna from Caribbean islands (Squamata, Mabuyidae, Mabuyinae). *Zootaxa* 3288: 1–244. <https://doi.org/10.11646/zootaxa.3288.1.1>
- Hérnandez IU, Ellis EA, Gallo CA (2013) Aplicación de teledetección y sistemas de información geográfica para el análisis de deforestación y deterioro de las selvas tropicales en la región Uxpanapa, Veracruz. *GeoFocus* 13: 1–24.
- Hernández-Ordóñez O, Arroyo-Rodríguez V, González-Hernández A, Russildi G, Luna-Reyes R, Martínez-Ramos M, Reynoso VH (2015) Range extensions of amphibians and reptiles in the southeastern part of the Lacandona rainforest, Mexico. *Revista Mexicana de Biodiversidad* 86: 457–468. <https://doi.org/10.1016/j.rmb.2015.04.005>
- IUCN [International Union for Conservation of Nature]. (2021) The IUCN Red List of Threatened Species. Version 2021-1. <http://www.iucnredlist.org> [accessed on June 25, 2021]
- Iverson JB, Le M, Ingram C (2013) Molecular phylogenetics of the mud and musk turtle family Kinosternidae. *Molecular Phylogenetics and Evolution* 69: 929–939. <https://doi.org/10.1016/j.ympev.2013.06.011>
- Jadin RC, Blair C, Orlofske SA, Jowers MJ, Rivas GA, Vitt LJ, Ray JM, Smith EN, Murphy JC (2020) Not withering on the evolutionary vine: systematic revision of the Brown Vine Snake (Reptilia: Squamata: *Oxybelis*) from its northern distribution. *Organisms Diversity & Evolution* 20: 723–746. <https://doi.org/10.1007/s13127-020-00461-0>
- Johnson JD, Mata-Silva V, Ramírez-Bautista A (2010) The herpetofauna of southeastern Mexico: Biogeography and conservation. In: Wilson LD, Townsend JH, Johnson J (Eds) *Conservation of Mesoamerican amphibians and reptiles*. Eagle Mountain Publishing, Utah, 322–369.
- Johnson JD, Wilson LD, Bryson Jr RW, Köhler G, Nicholson K, Schuett GW, Townsend JH (2018) Herpetofaunal List for Mesoamerica. *Mesoamerican Herpetology*. <http://www.mesoamericanherpetology.com/taxonomic-list.html> [accessed on March 5, 2018]
- Köhler G (2010) A revision of the Central American species related to *Anolis pentaprion* with the resurrection of *A. beckeri* and the description of a new species (Squamata: Polychrotidae). *Zootaxa* 2354: 1–18. <https://doi.org/10.11646/zootaxa.2354.1.1>
- Köhler G, Townsend JA, Petersen CB (2016) A taxonomic revision of the *Norops tropidonotus* complex (Squamata, Dactyloidea), with resurrection of *N. spilorhipis* (Álvarez del Toro and Smith, 1956) and the description of two new species. *Mesoamerican Herpetology* 3: 8–41.
- Köhler G, Trejo-Pérez RG, Petersen CB, Méndez de la Cruz F (2014) A revision of the Mexican *Anolis* (Reptilia, Squamata, Dactyloidae) from the Pacific versant west of the Isthmus de Tehuantepec in the states of Oaxaca, Guerrero, and Puebla, with the description of six new species. *Zootaxa* 3862: 1–210. <https://doi.org/10.11646/zootaxa.3862.1.1>

- Lee JC (1996) The Amphibians and Reptiles of the Yucatan Peninsula. Cornell University Press, Ithaca, 512 pp.
- Linkem CW, Diesmos AC, Brown RF (2011) Molecular systematics of the Philippine forest skinks (Squamata: Scincidae: *Sphenomorphus*): testing morphological hypotheses of inter-specific relationship. *Zoological Journal of the Linnean Society* 163: 1217–1243. <https://doi.org/10.1111/j.1096-3642.2011.00747.x>
- Lira-Torres I, Galindo-Leal C, Briones-Salas M (2012) Mamíferos de la Selva Zoque, México: riqueza, uso y conservación. *Revista de Biología Tropical* 60: 781–797. <https://doi.org/10.15517/rbt.v60i2.3999>
- López-Luna M (2017) Estado actual de la diversidad y poblaciones de los anfibios y reptiles de Los Tuxtlas. In: Reynoso VH, Coates RI, Vázquez-Cruz ML (Eds) Avances y Perspectivas en la Investigación de los Bosques Tropicales y sus Alrededores: la Región de Los Tuxtlas. Instituto de Biología, Universidad Nacional Autónoma de México, Mexico, 347–369.
- Luna-Reyes R, Cundapí-Pérez C, Pérez-López PE, López-Villafuerte A, Rodríguez-Reyes MÁ, Luna-Sánchez JA (2017) Riqueza y diversidad de anfibios y reptiles en Nuevo San Juan Chamula y Veinte Casas, Reserva de la Biosfera Selva El Ocote, Chiapas. In: Ruiz-Montoya L, Álvarez-Gordillo G, Ramírez-Marcial N, Cruz-Salazar B (Eds) Vulnerabilidad Social y Biológica Ante el Cambio Climático en la Reserva de la Biosfera Selva El Ocote. El Colegio de la Frontera Sur, Chiapas, 355–393.
- Lynch FJ, Wake DB (1989) Two new species of *Pseudoeurycea* (Amphibia: Caudata) from Oaxaca, Mexico. Contributions in Science, Natural History Museum of Los Angeles County 411: 11–22.
- Magurran AE (2004) Measuring Biological Diversity. Blackwell Publishing, Oxford, 256 pp.
- McCranie JR, Hedges SB (2016) Molecular phylogeny and taxonomy of the *Epictia goudotii* species complex (Serpentes: Leptotyphlopidae: Epictinae) in Middle America and northern South America. PeerJ 4: e1551. <https://doi.org/10.7717/peerj.1551>
- McCranie JR, Matthews AJ, Hedges SB (2020) A morphological and molecular revision of lizards of the genus *Marisora* Hedges & Conn (Squamata: Mabuyidae) from Central America and Mexico, with descriptions of four new species. Zootaxa 4763: 301–353. <https://doi.org/10.11646/zootaxa.4763.3.1>
- Meza-Lázaro RN, Nieto-Montes de Oca A (2015) Long forsaken species diversity in the Middle American lizard *Holcosus undulatus*. *Zoological Journal of the Linnean Society* 175: 189–210. <https://doi.org/10.1111/zoj.12264>
- Miller K, Chang E, Johnson N (2001) Defining Common Ground for the Mesoamerican Biological Corridor. World Resources Institute, Washington, District of Columbia, 45 pp.
- Monterrubio-Solís C, Newing HS (2013) Challenges in ICCA Governance: The case of El Cordon del Retén in San Miguel Chimalapa, Oaxaca. In: Porter-Bolland L, Ruiz-Mallén I, Camacho-Benavides C, McCandless SR (Eds) Community Action for Conservation Mexican Experiences. Springer, New York, 63–82. https://doi.org/10.1007/978-1-4614-7956-7_5
- Morrone JJ (2005) Hacia una síntesis biogeográfica de México. *Revista Mexicana de Biodiversidad* 76: 207–252. <https://doi.org/10.22201/ib.20078706e.2005.002.303>
- Muñoz-Alonso LA, Nieblas-Camacho J, Chau-Cortez MA, González-Navarro AB, López-Pérez J, Pérez-López J (2017) Diversidad de anfibios y reptiles en la Reserva de la Biosfera Selva El Ocote: su vulnerabilidad ante la fragmentación y el cambio climático. In: Ruiz-Montoya

- L, Álvarez-Gordillo G, Ramírez-Marcial N, Cruz-Salazar B (Eds) Vulnerabilidad social y biológica ante el cambio climático en la Reserva de la Biosfera Selva El Ocote. El Colegio de la Frontera Sur, Chiapas, 395–447.
- Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hot-spots for conservation priorities. *Nature* 403: 853–858. <https://doi.org/10.1038/35002501>
- Navarro-Sigüenza AG, Meave del Castillo JA (1998) Inventario de la biodiversidad de vertebrados terrestres de los Chimalapas, Oaxaca. Informe final SNIB-CONABIO, proyecto No. B002. Universidad Nacional Autónoma de México. Facultad de Ciencias. México, D.F.
- Nieto-Montes de Oca A, Barley AJ, Meza-Lázaro RN, García-Vázquez UO, Zamora-Abrego JG, Thomson RC, Leaché AD (2017) Phylogenomics and species delimitation in the knob-scaled lizards of the genus *Xenosaurus* (Squamata: Xenosauridae) using ddRADseq data reveal a substantial underestimation of diversity. *Molecular Phylogenetics and Evolution* 106: 241–253. <https://doi.org/10.1016/j.ympev.2016.09.001>
- Nuñez-Orantes O, Muñoz-Alonso A (2000) Inventario Herpetofaunístico de la reserva de la biosfera La Sepultura, Chiapas, México. Informe final SNIB-CONABIO, proyecto No. L003. Secretaría de Medio Ambiente Vivienda e Historia Natural. México, D.F.
- Ortiz-Pérez MA, Hernández-Santana JR, Figueroa JM (2004) Reconocimiento fisiográfico y geomorfológico. In: García-Mendoza AJ, Ordóñez MJ, Briones-Salas MA (Eds) Biodiversidad de Oaxaca. Instituto de Biología, UNAM, Fondo Oaxaqueño para la Conservación de la Naturaleza, World Wildlife Fund, Mexico, 43–54.
- Pérez-Farrera1 MA, Espinosa-Jiménez JA, López A, Gómez-Domínguez H, Gordillo-Ruiz MC (2016) Flora y vegetación de la Selva Zoque de Chiapas. In: Semahn (Ed.) Ecoregión Zoque: Retos y Oportunidades Ante el Cambio Climático. Secretaria de Medio Ambiente e Historia Natural, Chiapas, 52–76.
- Peterson AT, Navarro-Sigüenza A, Hernández-Baños BE, Escalona-Segura G, Rebón-Gallardo F, Rodríguez-Ayala E, Figueroa-Esquivel EM, Cabrera-García L (2003) The Chimalapas Region, Oaxaca, Mexico: a high-priority region for bird conservation in Mesoamerica. *Bird Conservation International* 13: 227–253. <https://doi.org/10.1017/S0959270903003186>
- Porras LW, Wilson LD, Schuett GW, Relserer RS (2013) A taxonomic reevaluation and conservation assessment of the common cantil, *Agkistrodon bilineatus* (Squamata: Viperidae): a race against time. *Amphibian and Reptile Conservation* 7: 48–73.
- Pulsford SA, Driscoll DA, Barton PS, Lindenmayer DB (2017) Remnant vegetation, plantings and fences are beneficial for reptiles in agricultural landscapes. *Journal of Applied Ecology* 54: 1710–1719. <https://doi.org/10.1111/1365-2664.12923>
- Ramírez-Reyes T, Flores-Villela O, Piñero D, Lathrop A, Murphy RW (2021) Genomic assessment of the *Phyllodactylus tuberculosus* complex (Reptilia: Phyllodactylidae) in America. *Zoologica Scripta*. <https://doi.org/10.1111/zsc.12492>
- Reyes-Velasco J, Adams RH, Boissinot S, Parkinson CL, Campbell JA, Castoe TA, Smith EN (2020) Genome-wide SNPs clarify lineage diversity confused by coloration in coralsnakes of the *Micruurus diastema* species complex (Serpentes: Elapidae). *Molecular Phylogenetics and Evolution* 147: e106770. <https://doi.org/10.1016/j.ympev.2020.106770>
- Reynoso VH, Paredes-León R, González-Hernández A (2011) Anfibios y reptiles del estado de Chiapas con algunos comentarios sobre los reportes y estudios de diversidad herpeto-

- faunística en la región. In: Álvarez F (Ed.) Chiapas: Estudios sobre su diversidad biológica. Universidad Nacional Autónoma de México, Mexico, 459–509.
- Rodríguez-Gómez F, Gutiérrez-Rodríguez C, Ornelas JF (2013) Genetic, phenotypic and ecological divergence with gene flow at the Isthmus of Tehuantepec: The case of the azure-crowned hummingbird (*Amazilia cyanocephala*). *Journal of Biogeography* 40: 1360–1373. <https://doi.org/10.1111/jbi.12093>
- Ruane S, Bryson Jr RW, Pyron RA, Burbrink FT (2014) Coalescent species delimitation in milksnakes (Genus *Lampropeltis*) and impacts on phylogenetic comparative analyses. *Systematic Biology* 63: 231–250. <https://doi.org/10.1093/sysbio/syt099>
- Scarpetta S, Gray L, Nieto Montes de Oca A, Castañeda M, Herrel A, Losos JB, Luna-Reyes R, Jímenez-Lang N, Poe S (2015) Morphology and ecology of the Mexican cave anole *Anolis alvarezdeltoroi*. *Mesoamerican Herpetology* 2: 261–270.
- SEMARNAT [Secretaría de Medio Ambiente y Recursos Naturales] (2001) Programa de manejo Reserva de la Biosfera Selva El Ocote. SEMARNAT, CONANP, Chiapas, México, 144 pp.
- SEMARNAT [Secretaría de Medio Ambiente y Recursos Naturales] (2010) Norma Oficial Mexicana NOM-059. Protección ambiental de especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. Proyecto de Modificación. Agosto 2018. México D.F., México. Diario Oficial de la Federación.
- Semlitsch RD, Bodie JR (2003) Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. *Conservation Biology* 17: 1219–1228. <https://doi.org/10.1046/j.1523-1739.2003.02177.x>
- Smith GC, Lewis T, Hogan LD (2015) Fauna community trends during early restoration of alluvial open forest/Woodland ecosystems on former agricultural land. *Restoration Ecology* 23: 787–799. <https://doi.org/10.1111/rec.12269>
- Taylor EH (1951) A new Veracrucian salamander. *The University of Kansas Science Bulletin* 34: 189–193.
- Uetz P, Freed P, Hošek J (2018) The Reptile Database. <http://www.reptile-database.org> [accessed on July 28, 2018]
- Vidal-Zepeda R (1990) Mapa de precipitación media anual, escala 1: 4000000. En Precipitación. Tomo II, Sección IV, 4.6. Atlas Nacional de México (1990–1992). Instituto de Geografía, UNAM, Mexico.
- Wallach V (2016) Morphological review and taxonomic status of the *Epictia phenops* species group of Mesoamerica, with description of six new species and discussion of South American *Epictia albifrons*, *E. goudotii*, and *E. tenella* (Serpentes: Leptotyphlopidae: Epictinae). *Mesoamerican Herpetology* 3: 215–374.
- Wendt T (1987) Las selvas de Uxpanapa, Veracruz-Oaxaca, México: Evidencia de refugios florísticos cenozoicos. *Anales del Instituto de Biología, Serie Botánica* 58: 29–54.
- Wilson LD, Mata-Silva V, Johnson JD (2013) A conservation reassessment of the reptiles of Mexico based on the EVS measure. *Amphibian and Reptile Conservation* 7: 1–47.
- Wüster W, Ferguson JE, Quijada-Mascareñas JA, Pook CE, Graca-Salomao M, Thorpe RS (2005) Tracing an invasion: landbridges, refugia, and the phylogeography of the Neotropical rattlesnake (Serpentes: Viperidae: *Crotalus durissus*). *Molecular Ecology* 14: 1095–1108. <https://doi.org/10.1111/j.1365-294X.2005.02471.x>

Appendix I

List of native reptile species recorded in the Selva Zoque region and seven other regions in northern Mesoamerica, their distribution range and conservation status. Abbreviations: a = species recorded during our fieldwork. LS = La Sepultura, LT = Los Tuxtlas, MF = Mayan Forest, SZ = Selva Zoque. NA = Species not considered in the EVS system. Exotic species recorded in the evaluated regions: *Anolis cristatellus* (Calakmul), *Anolis sagrei* (Selva Zoque, Los Tuxtlas, Calakmul, Sian Ka'an and Mayan Forest), *Gehyra mutilata* (Selva Zoque), *Hemidactylus frenatus* (Selva Zoque, Las Choapas, Lacandona, Los Tuxtlas, Calakmul and Sian Ka'an), *Hemidactylus turcicus* (Los Tuxtlas, La Sepultura) and *Indotyphlops braminus* (Las Choapas, Los Tuxtlas).

	Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtlas	La Sep-ultra	Calak-mul	Sian Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS
CLASS REPTILIA														
Order Squamata														
Suborder Lacertilia														
Anguidae														
<i>Abronia bogerti</i> Tihen	SZ	1	0	0	0	0	0	0	0	0	0	P	Data Deficient	18
<i>Abronia chiszarri</i> Smith & Smith	LT	0	0	0	1	0	0	0	0	0	0	P	Endangered	17
<i>Abronia morenica</i> Clause, Luna-Reyes & Nieto-Montes de Oca	LS	0	0	0	0	1	0	0	0	0	0	Not evaluated	NA	NA
<i>Abronia ornelasi</i> Campbell	SZ	1	0	0	0	0	0	0	0	0	0	P	Data Deficient	18
<i>Abronia ramireza</i> Campbell	LS	0	0	0	0	1	0	0	0	0	0	P	Data Deficient	18
<i>Abronia reidi</i> Werler & Shannon	LT	0	0	0	1	0	0	0	0	0	0	P	Data Deficient	18
<i>Celostus emeagammus</i> (Cope)	MAM _x	1	0	0	0	0	0	0	0	0	0	Pr	Least Concern	14
<i>Celostus ingridae</i> (Werler & Campbell)	LT	0	0	0	1	0	0	0	0	0	0	Pr	Data Deficient	17
<i>Celostus rozellae</i> (Smith) ^a	MA	1	0	1	0	0	0	0	0	0	1	Pr	Least Concern	13
<i>Geophonotus lioccephalus</i> Wiegmann	MAM _x	1	0	0	1	1	0	0	0	0	0	Pr	Least Concern	6
Corytophanidae														
<i>Basiliscus vittatus</i> Wiegmann ^a	WD	1	1	1	1	1	1	1	1	1	1	Pr	Least Concern	7
<i>Corytophanes cristatus</i> (Merrem)	WD	0	0	1	0	0	1	1	1	1	1	Pr	Least Concern	11
<i>Corytophanes hernandesii</i> (Wiegmann) ^a	MA	1	1	1	1	1	1	1	0	1	1	Pr	Least Concern	13
<i>Laemanctus longipes</i> Wiegmann	MA	1	0	1	1	0	1	0	1	0	1	Pr	Least Concern	9
<i>Laemanctus serratus</i> Cope	MA	0	0	0	1	0	1	1	1	0	0	Pr	Least Concern	8
Dactyloidae														
<i>Anolis alvarezedetoroi</i> Nieto-Montes de Oca ^a	MAM _x	1	0	0	0	0	0	0	0	0	0	Pr	Data Deficient	17
<i>Anolis barkeri</i> (Schmidt)	MAM _x	1	1	0	1	0	0	0	0	0	0	Vulnerable	15	
<i>Anolis beckeri</i> Boulenger ^a	MA	1	1	1	1	0	1	0	1	0	1	Pr	Least Concern	12
<i>Anolis biporcatus</i> (Wiegmann) ^a	WD	1	1	1	1	0	1	1	1	1	1	Pr	Not evaluated	10
<i>Anolis boulengerianus</i> Thomonot	MAM _x	1	0	0	0	0	0	0	0	0	0	Pr	Data Deficient	16
<i>Anolis capito</i> Peters	MA	1	0	1	0	0	0	0	1	0	1	Pr	Least Concern	13

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtlas	La Sep-ultra	Calak-mul	Sian Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS	
<i>Anolis compressicardus</i> Smith & Kerster ^a	MAMx	1	0	0	0	0	0	0	0	0	Least Concern	15	High	
<i>Anolis cuprinus</i> Smith	MAMx	1	0	0	0	1	0	0	0	0	Pr	Least Concern	16	High
<i>Anolis duellmani</i> Fitch & Henderson	LT	0	0	0	1	0	0	0	0	0	Pr	Data Deficient	17	High
<i>Anolis laeviventris</i> (Wiegmann)	MA	1	0	0	1	1	0	0	1	1	Not evaluated	9	Low	
<i>Anolis lemurinus</i> Cope ^a	MA	1	1	1	1	0	1	1	1	1	Least Concern	8	Low	
<i>Anolis matudai</i> Smith	MA	0	0	0	0	1	0	0	0	0	A	Least Concern	13	Medium
<i>Anolis parvicirculatus</i> Alvarez del Toro & Smith	SZ	1	0	0	0	0	0	0	0	0	A	Least Concern	16	High
<i>Anolis petersii</i> Bocourt	MA	1	0	0	1	0	0	0	0	0	Not evaluated	9	Low	
<i>Anolis purpureolectes</i> Gray, Meza-Lázaro, Poe & Nieto-Montes de Oca ^a	SZ	1	0	0	0	0	0	0	0	0	Not evaluated	16	High	
<i>Anolis pygmaeus</i> Alvarez del Toro & Smith ^a	MAMx	1	0	0	0	0	0	0	0	0	Pr	Endangered	16	High
<i>Anolis rodriguezii</i> Bocourt ^a	MA	1	1	1	0	1	1	1	1	1	Least Concern	10	Medium	
<i>Anolis sericeus</i> Hallowell ^a	MA	1	1	0	1	1	1	1	1	0	Least Concern	8	Low	
<i>Anolis spilorhynchis</i> (Alvarez del Toro & Smith)	MAMx	1	0	0	0	0	0	0	0	0	NA	NA	NA	NA
<i>Anolis tropidonotus</i> Peters	MA	0	1	1	0	1	0	1	1	1	Least Concern	7	Low	
<i>Anolis uniformis</i> Cope	MA	0	0	1	1	0	0	0	0	1	Least Concern	13	Medium	
<i>Anolis unilobatus</i> Köhler & Vesely	MA	1	0	1	0	0	0	0	0	1	Least Concern	7	Low	
Eublepharidae														
<i>Coleonyx elegans</i> Gray ^a	MA	1	0	1	1	1	1	1	1	1	A	Least Concern	9	Low
Gymnophthalmidae														
<i>Gymnophthalmus speciosus</i> (Hallowell)	WD	0	0	0	0	1	0	0	0	0	Pr	Least Concern	9	Low
Helodermatidae														
<i>Heloderma horridum</i> (Wiegmann)	MA	1	0	0	0	1	0	0	0	0	A	Least Concern	11	Medium
Iguanidae														
<i>Cachryx defensor</i> (Cope)	MA	0	0	0	0	0	1	1	1	0	P	Vulnerable	15	High
<i>Ctenosaura acanthura</i> (Shaw)	MA	1	1	0	1	0	0	0	0	0	Pr	Least Concern	12	Medium
<i>Ctenosaura pectinata</i> (Wiegmann)	MA	1	0	0	0	0	0	0	0	0	A	Least Concern	15	High
<i>Ctenosaura similis</i> (Gray)	WD	1	0	1	0	1	0	1	1	1	A	Least Concern	8	Low
<i>Iguana iguana</i> (Linnaeus) ^a	WD	1	1	1	1	1	0	0	1	1	Pr	Least Concern	12	Medium
Mabuyidae														
<i>Marisora lineola</i> McCranie, Matthews & Hedges	MA	0	1	1	0	1	1	1	1	1	Not evaluated	NA	NA	NA
<i>Marisora syntoma</i> McCranie, Matthews & Hedges	MAMx	1	0	0	0	1	0	0	0	0	Not evaluated	NA	NA	NA
Phyllodactylidae														
<i>Phyllodactylus magnus</i> Taylor	MAMx	1	0	0	0	1	0	1	0	1	Pr	Least Concern	10	Medium
<i>Thecadactylus rapicauda</i> (Houttuyn)	WD	0	0	1	0	0	1	1	1	1	Pr	Least Concern	10	Medium
Phrynosomatidae														
<i>Phrynosoma asio</i> Cope	MA	1	0	0	0	0	0	0	0	0	Pr	Least Concern	11	Medium

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtla-s	La Sep-ultra	Cala-kmul	Sián Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS
<i>Sceloporus carinatus</i> Smith	MA	1	0	0	0	1	0	0	0	0	Least Concern	12	Medium
<i>Sceloporus chrysostictus</i> Cope	MA	0	0	0	0	1	1	1	1	0	Least Concern	13	Medium
<i>Sceloporus cozumelae</i> Jones	MAM _x	0	0	0	0	0	0	0	0	0	Least Concern	15	High
<i>Sceloporus internasalis</i> Smith & Bumzahem ^a	MA	1	0	0	0	0	0	0	0	0	Least Concern	11	Medium
<i>Sceloporuslundelli</i> Smith	MA	0	0	0	0	0	0	1	1	1	Least Concern	14	High
<i>Sceloporusmelanorhinus</i> Bocourt	MA	1	0	0	0	1	0	0	0	0	Least Concern	9	Low
<i>Sceloporussalvini</i> Günther	MAM _x	0	0	0	1	0	0	0	0	0	A	Data Deficient	15
<i>Sceloporusserifer</i> Cope	WD	0	0	1	0	1	0	0	0	1	A	Least Concern	6
<i>Sceloporussiniferus</i> Cope	MAM _x	1	0	0	0	1	0	0	0	0	Least Concern	11	Medium
<i>Sceloporussmithi</i> Hartweg & Oliver	MAM _x	1	0	0	0	0	0	0	0	0	Least Concern	15	High
<i>Sceloporusstejnensis</i> Günther	MA	1	0	1	1	0	0	0	0	0	Least Concern	13	Medium
<i>Sceloporusvariabilis</i> Wiegmann ^a	WD	1	1	0	0	1	0	0	0	0	Least Concern	5	Low
<i>Umaurus bicarinatus</i> (Duméril)	MA	1	0	0	0	1	0	0	0	0	Least Concern	12	Medium
Scincidae													
<i>Mesoscincus schwartzei</i> (Fischer)	MAM _x	0	0	1	0	0	1	1	1	1	Least Concern	11	Medium
<i>Plestiodonsumichrasti</i> (Cope) ^a	MA	1	0	1	1	0	1	1	1	1	Least Concern	12	Medium
<i>Scincellaassata</i> (Cope)	MA	1	0	0	0	1	0	0	0	0	Least Concern	7	Low
<i>Scincellacherriei</i> (Cope) ^a	MA	1	1	1	1	0	1	1	1	1	Least Concern	8	Low
<i>Scincellagemmingeri</i> (Cope)	MAM _x	1	0	0	1	0	0	0	0	0	Least Concern	11	Medium
<i>Scincellaincerata</i> (Stuart)	MA	0	0	0	0	1	0	0	0	0	Least Concern	13	Medium
<i>Scincellasilvicola</i> (Taylor)	MAM _x	1	0	0	0	0	0	0	0	0	Least Concern	12	Medium
Sphaerodactylidae													
<i>Gonatodesalbogularis</i> (Duméril & Bibron)	WD	1	0	0	0	0	0	0	0	0	Pr	Least Concern	11
<i>Sphaerodactylusglaucus</i> Cope	MA	1	1	1	1	1	1	1	1	1	Pr	Least Concern	12
<i>Sphaerodactylusmillepunctatus</i> (Hallowell)	MA	0	0	1	0	0	0	0	0	1	Least Concern	10	Medium
Teiidae													
<i>Aspidoscelisangusticeps</i> (Cope)	MA	0	0	0	0	0	1	1	1	1	Least Concern	13	Medium
<i>Aspidoscelisdeppei</i> (Wiegmann)	MA	1	1	0	1	1	1	1	0	0	Least Concern	8	Low
<i>Aspidoscelisguttata</i> (Wiegmann)	MAM _x	1	0	0	1	1	0	0	0	0	Least Concern	12	Medium
<i>Aspidoscelismaslini</i> (Fritts)	MA	0	0	0	0	0	0	0	1	1	A	Least Concern	15
<i>Aspidoscelismotaguae</i> (Sackett)	MA	1	0	0	0	0	0	0	0	0	Least Concern	12	Medium
<i>Holcosusamphigrammus</i> (Smith and Laufe) ^a	MAM _x	1	1	0	1	0	0	0	0	0	Not evaluated	11	Medium
<i>Holcosuschaitzami</i> (Stuart)	MA	0	0	0	0	0	0	0	0	1	Data Deficient	NA	NA
<i>Holcosusfestivus</i> (Lichtenstein & Martens)	WD	0	0	1	0	0	0	0	0	1	Least Concern	11	Medium
<i>Holcosusguineae</i> (Smith and Laufe)	MAM _x	0	0	0	0	0	1	1	1	0	Not evaluated	13	Medium
<i>Holcosushartwegi</i> (Smith)	MA	0	0	1	0	0	0	0	1	0	Not evaluated	12	Medium

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtlas	La Sep-ultra	Cala-kmul	Sian Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS
<i>Holcosus parvus</i> (Barbour & Noble)	MA	1	0	0	1	0	0	0	0	0	Not evaluated	13	Medium
Xantusiidae													
<i>Lepidophyma flavimaculatum</i> Duméril	MA	1	1	1	0	0	0	1	1	Pr	Least Concern	8	Low
<i>Lepidophyma lutezi</i> Smith & Alvarez del Toro	SZ	1	0	0	0	0	0	0	0	A	Endangered	16	High
<i>Lepidophyma mayae</i> Bezy	MA	0	0	0	0	0	0	0	1		Near Threatened	NA	NA
<i>Lepidophyma paupernensis</i> Werler ^a	MAM _x	1	1	0	1	0	0	0	0		Least Concern	13	Medium
<i>Lepidophyma smithii</i> Bocourt	MA	1	0	0	0	1	0	0	0	Pr	Least Concern	8	Low
<i>Lepidophyma tuxtlae</i> Werler & Shannon ^a	MAM _x	1	1	0	1	0	0	0	0	A	Data Deficient	11	Medium
Xenosauridae													
<i>Xenosaurus arboreus</i> (Lynch & Smith)	SZ	1	0	0	0	0	0	0	0		Not evaluated	17	High
<i>Xenosaurus rackhami</i> Stuart	MA	1	0	0	0	0	0	0	0		Not evaluated	11	Medium
<i>Xenosaurus sandartiensis</i> Werler & Shannon	LT	0	0	0	1	0	0	0	0		Not evaluated	17	High
Suborder Serpentes													
Boidae													
<i>Boa imperator</i> Daudin	WD	1	1	1	1	1	1	1	1		Least Concern	10	Medium
Dipsadidae													
<i>Adelphicos latifasciatum</i> Lynch & Smith	LS	0	0	0	0	1	0	0	0	Pr	Data Deficient	15	High
<i>Adelphicos quadrivirgatum</i> Jan	MA	1	0	1	0	1	0	0	0		Last Concern	10	Medium
<i>Adelphicos visoninum</i> (Cope)	MA	0	1	0	1	0	0	0	0		Last Concern	12	Medium
<i>Anastridium sapperi</i> (Werner) ^a	MA	1	0	1	1	0	0	0	0		Last Concern	10	Medium
<i>Cenaspis aenigma</i> Campbell, Smith & Hall	SZ	1	0	0	0	0	0	0	0		Not evaluated	16	High
<i>Chersodromus australis</i> Canseco-Márquez, Ramírez-González & Campbell	SZ	1	0	0	0	0	0	0	0		Not evaluated	16	High
<i>Cletia cletia</i> (Daudin)	WD	0	0	0	0	0	0	0	0		Least Concern	8	Low
<i>Cletia scytalina</i> (Cope) ^a	MA	1	1	1	1	1	0	0	0		Last Concern	13	Medium
<i>Comiophanes bipunctatus</i> (Günther)	MA	0	1	1	1	1	0	0	0		Last Concern	10	Medium
<i>Comiophanes fissidens</i> (Günther) ^a	WD	1	1	1	1	1	0	0	0		Last Concern	7	Low
<i>Comiophanes imperialis</i> (Baird & Girard) ^a	WD	1	1	1	1	0	1	1	1		Last Concern	8	Low
<i>Comiophanes piceivittis</i> Cope	MA	1	0	0	1	1	0	0	0		Last Concern	7	Low
<i>Comiophanes quinquevittatus</i> (Duméril, Bibron & Duméril)	MA	0	0	1	1	0	0	0	1		Last Concern	13	Medium
<i>Comiophanes schmidti</i> Bailey	MA	0	0	1	0	0	1	1	1		Least Concern	13	Medium
<i>Conophis lineatus</i> (Duméril, Bibron & Duméril)	MA	0	0	0	1	0	0	0	1		Last Concern	9	Low
<i>Conophis morai</i> Pérez-Higareda, López-Luna & Smith	LT	0	0	0	1	0	0	0	0		Data Deficient	17	High
<i>Conophis vittatus</i> Peters	MA	0	0	0	0	1	0	0	0		Least Concern	11	Medium
<i>Dipsas brevifacies</i> (Cope)	MA	0	0	0	0	1	1	0	0	Pr	Last Concern	15	High

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtla-s	La Sep-ultra	Cala-kmul	Stan Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS	
<i>Enulius flavitorques</i> (Cope)	WD	0	0	0	0	1	0	0	0	0	Least Concern	5	Low	
<i>Geophis carinatus</i> Stuart	MA	1	0	1	1	0	0	0	0	0	Least Concern	8	Low	
<i>Geophis juliae</i> Pérez-Higareda, Smith & López-Luna	LT	0	0	0	1	0	0	0	0	0	Vulnerable	13	Medium	
<i>Geophis latitinctus</i> Smith & Williams	MAM _x	1	0	0	0	0	0	0	0	0	Least Concern	11	Medium	
<i>Geophis</i> sp. nov. ^a	SZ	1	0	0	0	0	0	0	0	0	Not evaluated	16	High	
<i>Imantodes cenchroides</i> (Linnaeus) ^a	WD	1	1	1	1	0	0	0	0	0	Least Concern	6	Low	
<i>Imantodes gemmistratus</i> (Cope)	WD	1	0	1	1	1	0	1	1	1	Pr	Least Concern	6	Low
<i>Imantodes tenuissimus</i> (Cope)	MAM _x	0	0	0	0	0	0	1	0	0	Pr	Least Concern	13	Medium
<i>Leptodeira annulata</i> (Linnaeus)	WD	1	1	0	1	1	0	0	0	0	Pr	Least Concern	6	Low
<i>Leptodeira frenata</i> (Cope)	MA	0	1	1	1	0	1	1	1	1	Pr	Least Concern	12	Medium
<i>Leptodeira maculata</i> (Hallowell)	MA	0	0	0	0	0	1	0	0	0	Pr	Least Concern	7	Low
<i>Leptodeira nigrofasciata</i> Günther	MA	1	0	0	0	0	0	0	0	0	Least Concern	8	Low	
<i>Leptodeira polysticta</i> (Günther) ^a	MA	1	1	0	1	0	0	0	0	0	Not evaluated	6	Low	
<i>Leptodeira septentrionalis</i> (Kennicott)	WD	0	0	1	0	1	1	0	0	0	Least Concern	8	Low	
<i>Manolepis putnami</i> (Jan)	MAM _x	1	0	0	0	1	0	0	0	0	Least Concern	13	Medium	
<i>Ninia diademata</i> Baird & Girard ^a	MA	1	1	1	0	1	0	1	0	1	Least Concern	9	Low	
<i>Ninia sebae</i> (Duméril, Bibron & Duméril) ^a	MA	1	1	1	1	0	1	1	1	1	Least Concern	5	Low	
<i>Oxyrhopus petolarius</i> (Linnaeus) ^a	WD	1	1	1	1	0	0	0	0	0	Least Concern	14	High	
<i>Pliocercus elapoides</i> Cope	WD	1	0	1	1	1	1	1	1	1	Least Concern	10	Medium	
<i>Rhadinaea decorata</i> (Günther) ^a	WD	1	1	1	1	0	0	0	0	1	Least Concern	9	Low	
<i>Rhadinaea macdougalii</i> Smith & Langebartel	SZ	1	0	0	0	0	0	0	0	0	Data Deficient	12	Medium	
<i>Rhadinaella anachoreta</i> (Smith & Campbell)	MA	0	0	0	0	0	0	0	0	0	Least Concern	NA	NA	
<i>Rhadinaella godmani</i> (Günther)	MA	1	0	0	0	0	0	0	0	0	Least Concern	10	Medium	
<i>Sibon dimidiatus</i> (Günther) ^a	MA	1	0	1	1	0	0	0	0	1	Least Concern	10	Medium	
<i>Sibon lineatus</i> Pérez-Higareda, López-Luna & Smith	LT	0	0	0	1	0	0	0	0	0	Data Deficient	16	High	
<i>Sibon nebulatus</i> (Linnaeus)	WD	1	0	1	1	0	1	0	1	0	Least Concern	5	Low	
<i>Sibon sanniolus</i> (Cope)	MA	0	0	0	0	0	1	1	1	1	Least Concern	12	Medium	
<i>Tretanorhinus nigroluteus</i> Cope	MA	0	0	1	1	0	0	1	1	1	Least Concern	10	Medium	
<i>Tropidodipsas fasciata</i> Günther	WD	1	0	0	1	1	1	1	0	0	Least Concern	13	Medium	
<i>Tropidodipsas fischeri</i> (Boulenger)	MA	0	0	0	0	0	0	0	0	0	Least Concern	11	Medium	
<i>Tropidodipsas sartorii</i> Cope	MA	1	1	1	1	0	1	1	1	1	Pr	Least Concern	9	Low
<i>Xenodon rhabdocephalus</i> (Wied-Neuwied)	WD	1	1	1	1	0	1	0	1	0	Least Concern	13	Medium	
Colubridae														
<i>Coluber constrictor</i> Linnaeus	WD	1	0	0	0	0	0	0	0	1	A	Least Concern	10	Medium
<i>Dendrophidion rufiterminorum</i> Cadle & Savage	MA	0	0	0	0	0	0	0	0	1	Not evaluated	NA	NA	
<i>Dendrophidion vittior</i> Smith ^a	MA	1	0	0	1	0	0	0	0	1	Least Concern	13	Medium	

Species	Distribution range	Selva Zoque		Las Choapas		Lacandonia		Los Tuxtla		La Sepultura		Calakmul		Sian Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulnerability according to the EVS
		Distribution range	Zoque	Selva	Zoque	Lacandonia	Zoque	Los Tuxtla	Tuxtla	La Sepultura	Calakmul	Calakmul	Calakmul	Sian Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulnerability according to the EVS
<i>Drymarchon melanurus</i> (Duméril, Bibron & Duméril) ^a	WD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Drymobius chloroticus</i> (Cope)	MA	1	0	0	1	1	0	0	0	0	0	0	0	0	0	Least Concern	8	Low	
<i>Drymobius marginatus</i> (Schlegel)	WD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Ficimia publia</i> Cope	MA	1	1	1	1	1	0	0	1	1	1	1	1	1	1	Least Concern	9	Low	
<i>Ficimia variegata</i> (Günther)	MAMx	0	0	0	1	0	0	0	0	0	0	0	0	0	0	Data Deficient	14	High	
<i>Masticophis mentovarius</i> (Duméril, Bibron & Duméril)	WD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Masticophis melanolomus</i> (Cope) a	WD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Lampropeltis abnorma</i> (Bocourt)	MA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	9	Low	
<i>Leptophis ahaetulla</i> (Linnaeus) ^a	WD	1	0	1	1	0	1	0	1	1	1	1	1	1	1	Least Concern	10	Medium	
<i>Leptophis diplotropis</i> (Günther)	MAMx	0	0	0	0	0	1	0	0	0	0	0	0	0	0	A	Least Concern	14	High
<i>Leptophis mexicanus</i> Duméril, Bibron & Duméril	WD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	A	Least Concern	6	Low
<i>Oxybelis potosiensis</i> (Taylor)	MAMx	1	0	1	1	1	1	1	1	1	1	1	1	1	1	Not evaluated	NA	NA	
<i>Oxybelis fulgidus</i> (Daudin)	WD	1	0	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	9	Low	
<i>Ptychadenax poecilonotus</i> (Günther)	MA	1	0	1	1	0	1	0	1	1	1	1	1	1	1	Least Concern	10	Medium	
<i>Pituophis lineaticollis</i> (Cope)	MA	1	0	0	0	0	0	1	0	1	1	1	1	1	1	Least Concern	8	Low	
<i>Pseudelaphe fluvirufa</i> (Cope)	MA	1	0	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	10	Medium	
<i>Salvadora lemniscata</i> (Cope)	MA	1	0	0	0	0	0	1	0	0	0	0	0	0	0	Pr	Least Concern	15	High
<i>Semniotolis triaspis</i> (Cope)	WD	1	0	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Spiolites pallatus</i> (Linnaeus) ^a	WD	1	0	1	1	1	1	1	1	1	1	1	1	1	1	Least Concern	6	Low	
<i>Stenorhina degenhardtii</i> (Berthold) ^a	WD	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Least Concern	9	Low	
<i>Stenorhina frenimivillei</i> (Duméril, Bibron & Duméril)	MA	1	0	1	0	0	1	0	0	0	0	0	0	0	0	Least Concern	7	Low	
<i>Symphimis leucostomum</i> Cope	MAMx	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Pr	Least Concern	14	High
<i>Sympimus mayae</i> (Gaige)	MA	0	0	0	0	0	0	0	1	1	1	1	1	1	1	Pr	Least Concern	14	High
<i>Tantilla briggsi</i> Savitzky & Smith	SZ	1	0	0	0	0	0	0	0	0	0	0	0	0	0	A	Data Deficient	16	High
<i>Tantilla cuniculator</i> Smith	MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Pr	Least Concern	NA	NA
<i>Tantilla jani</i> (Günther)	MA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Vulnerable	12	Medium	
<i>Tantilla moesta</i> (Günther)	MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Pr	Least Concern	NA	NA
<i>Tantilla rubra</i> Cope	MA	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Pr	Least Concern	5	Low
<i>Tantilla schistosa</i> (Bocourt)	MA	0	1	0	1	0	0	0	0	0	0	0	0	0	0	Pr	Least Concern	8	Low
<i>Tantilla slateri</i> Pérez-Higareda, Smith & Smith	LT	0	0	0	1	0	0	0	0	0	0	0	0	0	0	Pr	Data Deficient	14	High
<i>Tantilla tecta</i> Campbell & Smith	MF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Pr	Data Deficient	NA	NA
<i>Tantillita brevisima</i> (Taylor)	MA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	Pr	Least Concern	9	Low
<i>Tantillita canula</i> (Cope)	MA	0	0	0	0	0	0	1	0	0	0	0	0	0	0	Pr	Least Concern	12	Medium
<i>Tantillita lintoni</i> (Smith) ^a	MA	1	0	1	1	0	1	0	1	0	1	0	1	0	0	Pr	Least Concern	12	Medium
<i>Trimorphodon biscutatus</i> (Duméril, Bibron & Duméril)	MA	1	0	0	1	1	0	0	0	0	0	0	0	0	0	A	Not evaluated	7	Low
Natricidae	WD	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	Least Concern	10	Medium

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtla-s	La Sep-ultra	Calak-mul	Stan Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS	
<i>Thamnophis cyrtopsis</i> (Kennicott)	WD	1	0	0	0	0	0	0	0	0	A	Last Concern	7	Low
<i>Thamnophis marcianus</i> (Baird & Girard)	WD	0	0	1	0	0	1	0	0	0	A	Last Concern	10	Medium
<i>Thamnophis proximus</i> (Say)	WD	0	1	0	1	1	0	1	1	1	A	Last Concern	7	Low
Sybinophiidae														
<i>Scaphiodontophis annulatus</i> (Duméril, Bibron & Duméril) ^a	WD	1	0	1	1	1	0	0	0	1		Last Concern	11	Medium
Elapidae														
<i>Micruroides elegans</i> (Jan)	MAM _x	0	0	1	0	0	1	1	1	1		Not evaluated	NA	NA
<i>Micruroides browni</i> Schmidt & Smith	MA	1	0	0	0	1	0	0	0	0	Pr	Last Concern	8	Low
<i>Micruroides diastema</i> (Duméril, Bibron & Duméril) ^a	MA	1	1	0	1	0	0	0	0	0	Pr	Last Concern	8	Low
<i>Micruroides elegans</i> Jan	MA	1	1	1	1	0	0	0	0	0	Pr	Last Concern	13	Medium
<i>Micruroides limbatatus</i> Fraser	LT	0	0	0	1	0	0	0	0	0	Pr	Last Concern	17	High
Leptotyphlopidae														
<i>Epictia phenops</i> (Cope)	MA	1	0	0	0	1	0	0	0	0		Not evaluated	4	Low
<i>Epictia reticulata</i> Wallach	MAM _x	0	0	0	1	0	0	0	0	0		Not evaluated	11	Medium
Loxocenidae														
<i>Loxocemus bicolor</i> Cope	MA	1	0	0	0	1	0	0	0	0	Pr	Last Concern	10	Medium
Typhlopidae														
<i>Amerotyphlops microstomus</i> (Cope)	MA	0	0	0	0	0	1	0	1	0		Last Concern	12	Medium
<i>Amerotyphlops tenuis</i> (Salvin)	MA	1	0	0	1	0	0	0	0	0		Last Concern	11	Medium
Viperidae														
<i>Agkistrodon bilineatus</i> Günther	MA	0	0	0	0	1	1	0	1	1	Pr	Near Threatened	11	Medium
<i>Bohmeia bicolor</i> (Bocourt)	MA	0	0	0	0	1	0	0	0	0	A	Last Concern	14	High
<i>Bohmeia ruficeps</i> (Bogert)	MAM _x	1	0	0	0	0	0	0	0	0	Pr	Vulnerable	16	High
<i>Bohmeia schlegelii</i> (Berthold)	WD	1	0	1	0	0	0	0	0	0		Last Concern	12	Medium
<i>Bothrops asper</i> (Garman) ^a	WD	1	1	1	1	1	1	1	1	1		Not evaluated	12	Medium
<i>Crotaphidion godmani</i> (Günther)	MA	1	0	0	0	0	0	0	0	0		Last Concern	11	Medium
<i>Crotalus cerastes</i> Carabajal-Márquez, Cedeño-Vázquez, Martínez-Arce, Neri-Castro & Machkour-M'Rabet	MAM _x	1	1	0	0	0	0	0	0	0		Not evaluated	NA	NA
<i>Crotalus mictlantecuhtli</i> Carbajal-Márquez, Cedeño-Vázquez, Martínez-Arce, Neri-Castro & Machkour-M'Rabet	LT	0	0	0	1	0	0	0	0	0		Not evaluated	NA	NA
<i>Crotalus simus</i> Latreille	MA	0	0	1	0	0	0	0	0	0		Last Concern	11	Medium
<i>Crotalus tzabcan</i> Klauber	MAM _x	0	0	0	0	1	1	1	1	1		Last Concern	NA	NA
<i>Metlapilcoatlus mexicanus</i> (Duméril, Bibron & Duméril) ^a	MA	0	0	1	0	0	0	0	0	0		Last Concern	12	Medium
<i>Metlapilcoatlus olmec</i> (Pérez-Higareda, Smith & Julia-Zertuche) ^a	MA	1	0	0	1	0	0	0	0	0	A	Last Concern	15	High

Species	Distribu-tion range	Selva Zoque	Las Choapas	Lacan-dona	Los Tuxtlas	La Sep-ultra	Calak-mul	Stan Ka'an	Mayan Forest	NOM-059	IUCN RED LIST	EVS	Category of vulner-ability according to the EVS	
<i>Porthidium dunni</i> (Hartweg & Oliver)	MAMx	1	0	0	1	0	0	0	0	0	A	Least Concern	16	High
<i>Porthidium nasutum</i> (Bocourt)	WD	0	0	1	0	0	0	0	1	Pr	Least Concern	14	High	
<i>Porthidium yucatanicum</i> (Smith)	MA	0	0	0	0	0	0	1	0	Pr	Least Concern	17	High	
Order Testudines														
Suborder Cryptodira														
Cheloniidae														
<i>Caretta caretta</i> (Linnaeus)	WD	0	0	0	1	0	0	0	1	0	P	Vulnerable	NA	NA
<i>Chelonia mydas</i> (Linnaeus)	WD	0	0	0	1	0	0	0	1	0	P	Endangered	NA	NA
<i>Eretmochelys imbricata</i> (Linnaeus)	WD	0	0	0	1	0	0	0	1	0	P	Critically Endangered	NA	NA
<i>Lepidochelys kempii</i> Garmín	WD	0	0	0	1	0	0	0	0	0	P	Critically Endangered	NA	NA
Chelydridae														
<i>Chelydra rossignonii</i> (Bocourt)	MA	0	1	1	0	0	0	0	1	Pr	Vulnerable	17	High	
Dermatemydidae														
<i>Dermatemys mawii</i> Gray	MA	1	0	1	1	0	0	0	0	1	P	Critically Endangered	17	High
Dermochelyidae														
<i>Dermochelys coriacea</i> (Vandelli)	WD	0	0	0	1	0	0	0	1	0	P	Vulnerable	NA	NA
Emydidae														
<i>Terrapene carolina</i> (Linnaeus)	WD	0	0	0	0	0	1	0	0	Pr	Vulnerable	10	Medium	
<i>Trachemys venusta</i> (Gray)	WD	1	1	1	0	0	1	1	1	Pr	Not evaluated	13	Medium	
Geoemydidae														
<i>Rhinoclemmys areolata</i> (Duméril, Bibron & Duméril)	MA	0	1	1	0	1	1	1	1	A	Near Threatened	13	Medium	
<i>Rhinoclemmys pulcherrima</i> (Gray)	MA	0	0	0	1	0	0	0	0	A	Not evaluated	8	Low	
<i>Rhinoclemmys rubida</i> (Cope)	MAMx	1	0	0	0	1	0	0	0	Pr	Near Threatened	14	High	
Kinosternidae														
<i>Claudius angustatus</i> Cope	MA	0	1	0	1	0	1	0	1	P	Near Threatened	14	High	
<i>Kinosternon acutum</i> Gray ^a	MA	1	1	1	0	1	0	0	1	Pr	Near Threatened	11	Medium	
<i>Kinosternon creaseri</i> Hartweg	MAMx	0	0	0	0	1	1	1	0	0	Least Concern	15	High	
<i>Kinosternon leucostomum</i> (Duméril, Bibron & Duméril)	WD	1	1	1	1	0	1	1	1	Pr	Not evaluated	10	Medium	
<i>Kinosternon scorpioides</i> (Linnaeus) ^a	WD	1	0	1	1	1	1	1	1	Pr	Not evaluated	10	Medium	
<i>Stenorrhinus triporcatus</i> (Wiegmann)	MA	1	1	0	1	1	1	1	1	A	Near Threatened	14	High	
Order Crocodylia														
Suborder Eusuchia														
Crocodylidae														
<i>Crocodylus acutus</i> (Cuvier) ^a	WD	1	0	1	0	0	0	1	1	Pr	Vulnerable	14	High	
<i>Crocodylus moreletii</i> (Duméril & Bibron)	WD	1	1	1	1	0	1	1	1	Pr	Least Concern	13	Medium	